(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 046 466 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.10.2000 Bulletin 2000/43

(21) Application number: **00850065.4**

(22) Date of filing: **12.04.2000**

(51) Int. Cl.[7]: **B24D 13/12**, B24D 13/14, B24B 37/04 // H01L21/306

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **13.04.1999 US 129048 P**
10.04.2000 US 545982

(71) Applicant:
Freudenberg Nonwovens Limited Partnership
Durham, NC 27704 (US)

(72) Inventors:
- **Hsu, Oscar K.**
  Chelmsford, Massachusetts 01824 (US)
- **Vangsness, Jean K.**
  Stow, Massachusetts 01775 (US)
- **Billings, Scott C.**
  Kingston, New Hampshire 03848 (US)
- **Gilbride, David S.**
  Lowell, Massachusetts 01852 (US)

(74) Representative:
Wiklund, Ingrid Helena
AWAPATENT AB,
Box 5117
200 71 Malmö (SE)

(54) **Polishing pads useful in chemical mechanical polishing of substrates in the presence of a slurry containing abrasive particles**

(57) A polishing pad (10) for polishing semiconductors and other planar substrates in the presence of a slurry comprising abrasive particles and a dispersive agent is disclosed. The polishing pad (10) includes a soluble component (14), preferably fibrous, within a polymer matrix component (16). The fibrous component (14) includes fibers soluble in the slurry sufficiently to provide a void structure in the polishing surface (20) of the pad (10). The void structure enhances the polishing rate and uniformity by increasing the mobility of the abrasive particles while reducing scratching of the polished surface. Additives that further enhance polishing and/or assist in the removal of residues generated during polishing, such as surfactants and removers, are optionally incorporated in the fibrous substance or topographically coated on the fibrous substance.

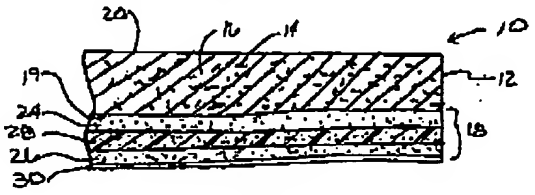

FIG. 1

EP 1 046 466 A2

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit under 35 U.S.C. § 112(e) of U.S. Provisional Application No. 60/129,048, filed April 13, 1999, the entire disclosure of which is incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT -N/A-

BACKGROUND OF THE INVENTION

[0002] Semiconductor devices are formed from a flat, thin wafer of a semiconductor material, such as silicon. The wafer must be polished to achieve a sufficiently flat surface with no or minimal defects. A variety of chemical, electrochemical, and chemical mechanical polishing techniques are employed to polish the wafers.

[0003] In chemical mechanical polishing ("CMP"), a polishing pad made of a urethane material is used in conjunction with a slurry to polish the wafers. The slurry comprises abrasive particles, such as aluminum oxide, cerium oxide, or silica particles, dispersed in an aqueous medium. The abrasive particles generally range in size from 100 to 200 nm. Other agents, such as surface acting agents, oxidizing agents, or pH regulators, are typically present in the slurry.

[0004] The urethane pad is textured, such as with channels or perforations, to aid in the distribution of the slurry across the pad and wafer and removal of the slurry and grindings therefrom. In one type of polishing pad, hollow, spherical microelements are distributed throughout the urethane material. As the surface of the pad is worn away through use, the microelements provide a continually renewable surface texture.

SUMMARY OF THE INVENTION

[0005] The present invention relates to a polishing pad for polishing a substrate in the presence of a slurry comprising abrasive particles and a dispersive agent. The polishing pad uses a component, preferably fibrous, within a polymer matrix component. The fibrous component is soluble in the slurry, such that fibers present at the polishing surface of the pad dissolve upon contact with the slurry to provide a void structure on the polishing surface. The void structure provides pores that enhance the polishing rate and uniformity by increasing the mobility of the abrasive particles in the slurry while reducing scratching of the polished surface. The pores act as temporary storage areas for the abrasive particles, thus reducing highly frictional contact between the abrasive particles and the polished surface.

[0006] More particularly, the polishing pad comprises a first layer having a polishing surface and a backing surface. The first layer is formed of the fibrous component in the polymer matrix component. The fibrous component comprises fibers soluble in the slurry sufficiently to provide a void structure in the polishing surface. The solvent may be either the dispersive phase of the abrasive particles or another material added to the slurry during polishing. The polishing pad also comprises a backing structure comprising an adhesive layer or layers fixed to the backing surface of the first layer, so that the polishing pad may be affixed to a tool.

[0007] The nature of the void structure on the polishing surface of the polishing pad is determined by parameters such as the rate of dissolution of the fibers in the solvent, the ratio of fibers to matrix, the shape and size of the fibers, the orientation of the fibers, the density of the fibers both in area and volume, and the presence and amount of any insoluble fibers. Suitable fibers for semiconductor wafer polishing, which are soluble in an aqueous slurry, include polyvinyl alcohol and maleic acid and their derivatives or copolymers.

[0008] Additives that further enhance polishing and/or assist in the removal of residues generated during polishing may be incorporated in the fibrous component or be applied as a topographic coating to the fibrous component. These additives are released at a controlled rate during polishing.

[0009] The polishing pad applies to a diversity of applications including semiconductor wafer polishing known as chemical mechanical polishing (CMP) and other polishing applications for metal, ceramic, glass, wafers, hard disks etc., that use a liquid medium to carry and disperse the abrasive particles.

DESCRIPTION OF THE DRAWINGS

[0010] The invention will be more fully understood by reference to the following detailed description when considered in conjunction with the accompanying drawings, in which:

Fig. 1 is a partial cross-sectional view of a polishing pad in accordance with the invention;
Fig. 2 is a partial top view of the polishing pad of Fig. 1 during use;
Fig. 3 is a partial cross-sectional view along line B-B of the polishing pad of Fig. 2; and
Fig. 4 is a partial cross-sectional view of a further embodiment of a polishing pad in accordance with the invention; and

DETAILED DESCRIPTION OF THE INVENTION

[0011] The present invention relates to a polishing pad 10 that is utilized in conjunction with a polishing slurry comprising a liquid medium that carries and disperses abrasive particles between the polishing pad and the surface being polished. Referring to Fig. 1, the preferred embodiment of the polishing pad incorporates

a layer 12 of a composite polishing material comprising a soluble fibrous component 14 encapsulated or embedded in a polymeric matrix component 16. The fibrous component is soluble in water or another solvent present in the polishing slurry at a rate sufficient to leave voids on the polishing surface of the pad. The solvent may be the dispersive phase of the abrasives or may be another material added to the slurry. In semiconductor wafer polishing, the slurry is typically an aqueous medium, and the solvent is thus water. Useful polymeric materials for the matrix component include most common structural polymers, such as polyurethanes, polyacrylates, polystyrenes, polyimides, polyamides, polycarbonates, and epoxies. Other polymers that have a rigidity sufficient to support the fibrous component may be used. An adhesive backing structure 18 is attached to the underside or backing surface 19 of the composite polishing material layer 12, so that the polishing pad may be affixed to a tool.

[0012] Before use, the surface 20 of the polishing material is smooth, as illustrated in Fig. 1. Although fibers are exposed at the surface, no dissolution has occurred to roughen the surface. Once the solvent contacts the fibrous component at the surface, the fibrous component begins to dissolve, forming a void structure of pores 22 in the surface, as illustrated schematically in Figs. 2 and 3. The pores on the surface of the polishing substance enhance the polishing rate and uniformity by increasing the mobility of the abrasives while reducing scratching of the polished surface. The pores act as temporary storage areas for the abrasive particles, thus reducing highly frictional contact between the abrasive particles and the polished surface.

[0013] The fibrous component may be formed of any suitable soluble fiber material, such as polyvinyl alcohol (PVAc), maleic acid, polyacrylic acid, various polysaccharides and gums, or derivatives of these materials. Copolymers of these polymers may also be used. The particular fiber material is selected depending on the particular solvent to be used and the intended polishing application. In semiconductor wafer polishing, the slurry typically uses an aqueous medium as the dispersive phase for the abrasive particles. Thus, water is typically the preferred solvent for this application, and PVAc, copolymers of PVAc, maleic acid, and derivatives of these materials are suitable for the fibrous component. Other solvents and fiber materials may be used, however, depending on the application.

[0014] For semiconductor wafer polishing, the fiber material is preferably chosen such that the rate of dissolution of the fibrous component in the dissolving medium is as fast as possible. Preferably, the fiber component dissolves as soon as it contacts the dissolving medium, so that no delay is needed before polishing can begin. For example, PVAc and maleic acid and their derivatives dissolve suitably quickly in water. The rate of dissolution can be controlled by the particular material chosen. For example, the salt of a compound can render the compound more or less hydrolyzable by an aqueous medium. Polymerization can also be used to control the dissolution rate. For example, increasing the molecular weight can slow the rate of dissolution.

[0015] The fibrous material may be prepared by any suitable process, such as by nonwoven techniques, for example, chemical, mechanical, or thermal bonding of fibers or the laying down of a loose mat of fibers or filaments, as well as by weaving or knitting techniques, as would be known in the art. A nonwoven material is usually preferred, because it gives a more random orientation of pore structure. The orientation of the fibers relative to the polishing surface may be controlled to affect the size of the pores on the polishing surface. If the fibers are oriented predominantly parallel to the surface, the resulting void structure will have more channel-shaped or elongated pores. If the fibers are oriented predominantly orthogonally to the surface, the resulting void structure will have more pores of a smaller diameter. A greater density of pores over the polishing surface can be achieved with an orthogonal orientation of the fibers. Continuous fibers or cut fibers, having a fiber length of .5 mm to 15 mm, may be used. Cut fibers provide more fiber ends, resulting in a void structure with more holes.

[0016] The diameters of the fibers are selected such that the pore size after dissolution is complementary to the particle size of the abrasive particles in the slurry, which typically range in size from 100 to 200 nm. If the pores are too large, the slurry particles may stagnate in the pores, resulting in loss of their polishing effect. Also the location of the particles cannot be adequately controlled, leading to nonuniformities in polishing. If the pores are too small, the particles may become stuck in the pores, leading to scratching of the substrate to be polished. A fiber diameter range of 20 to 200 µm, and preferably 30 to 100 µm, has been found to provide a suitable range of pore sizes for the typical range of abrasive particles used in CMP slurries.

[0017] The ratio of the fiber component to the matrix component can vary from 90% fiber/10% matrix to 10% fiber/90% matrix by volume. A higher fiber component yields a softer, more compressible polishing material that is more suitable for polishing softer features, such as aluminum, tungsten, or copper wiring present on the substrate. A polishing material with a fiber content as high as 90% has a very fibrous structure, with fibers that are incompletely coated with the matrix material. A higher matrix component yields a harder polishing material that is more suitable for polishing a harder substrate, such as a silicon oxide layer. A polishing material with a fiber content as little as 10% is very solid and less compressible.

[0018] The composite material layer may also have a layered structure, such as an upper layer having a higher ratio of fibers to matrix and a lower layer having a lower ratio of fibers to matrix. The upper layer provides mobility of the slurry particles on the surface while the

lower layer provides greater rigidity to enhance planarity. In a variant, the lower layer may have no fibers. In another embodiment, a gradation of the ratio of fibers to matrix or of other properties may be provided from the polishing surface to the backing surface.

[0019] The fibrous component may also include some insoluble fiber material. The insoluble fiber acts as a sweep, isolating the hard surface of the matrix component from scratching the substrate to be polished. The amount of insoluble fiber may range up to 90% by mass.

[0020] In another embodiment, the soluble material may be particulate in nature, such as a powder. In this case, the powder dissolves at the surface upon contact with the solvent to form a void structure on the surface. In the interior of the pad, the powder provides a solid structure.

[0021] The thickness of the layer 12 of the composite polishing material ranges from .005 inch to .150 inch. The thickness of the layer determines the life of the pad. The thickness also determines physical properties of the pad. For example, a thicker layer is stiffer and more resistant to bending. The actual thickness selected depends on the particular application.

[0022] The backing structure 18 provides a medium for attaching the polishing pad to a tool and adds compressibility to complement the rigidity of the composite material layer. The rigidity of the composite material layer provides planarity on a small scale, that is, over a small region of the substrate to be polished. The compressibility of the backing structure provides uniformity of pressure over the entire substrate surface, for example over the 8 inch or 12 inch diameter of a semiconductor wafer. This ensures uniformity of polishing if, for example, the substrate is concavely or convexly curved or otherwise irregular.

[0023] In one embodiment, the backing structure 18 includes two layers 24, 26 of adhesive with a compressible structural layer 28 therebetween. The thickness of the backing structure ranges from 0.005 to 0.070 inch. The first adhesive layer is bonded to the composite polishing material and is selected to provided a strong bond to the composite material layer. The second adhesive layer allows the entire pad to be fixed to a tool and is selected to provide good cohesion, so that the pad may be removed from the tool without leaving a residue on the tool. Any suitable adhesive material may be used, such as acrylic or butyl rubber types, a hot melt adhesive containing an acrylic, polyethylene, polyvinyl, polyester, or nylon, or a mixture thereof. The second adhesive layer is protected by a release liner 30 that is removed prior to affixing the polishing pad to a tool.

[0024] The structural layer 28 is made of polymeric materials such as a film of polyester, or a foam of polyethylene, polystyrene, or derivatives or copolymers thereof. Other materials, such as extruded polyethylene or polystyrene sheets or a nonwoven polymer layer, may be used. The thickness of the structural layer is nominally 0.005 to 0.100 inch.

[0025] In a further embodiment, illustrated in Fig. 4, the backing structure is composed of a single adhesive layer 32 affixed to the underside of the polishing material layer. For example, if the composite material layer has a high fiber content, a single adhesive layer may provide sufficient compressibility for the pad. The single adhesive layer is covered by a release liner 34.

[0026] During polishing of a semiconductor wafer, the polymeric material of the matrix component shears or flows and forms a film over the surface of the pad, clogging the pores and diminishing the polishing effectiveness of the pad. Thus, after polishing a wafer, the surface of the pad is conditioned or dressed by diamond polishing. The rate of dissolution of the fibrous component is preferably greater than the rate of wear of the matrix component caused by this dressing step. The polishing surface is rejuvenated and renewed as the matrix component is depleted or wears down, because new areas of the fibrous component are exposed and dissolved, thus forming new pores for enhanced polishing action.

[0027] Other additives, such as surfactants and removers to enhance the stability of the residue particles and prevent them from redepositing onto the polished surface of the substrate, may be included in the composite material layer. These additives may be incorporated into the fibrous component, for example, by doping the polymeric material of the fiber before the fiber is extruded, or may be applied as a topographic coating to the fibers. In this way, the additives are released at a controlled rate during polishing. Typical additives contain, for example, silicon oil or fluorocarbon type release agents or other agents that are known additives to polishing slurries.

[0028] The polishing pad of the present invention is particularly suitable for the chemical mechanical polishing of semiconductor wafers. The polishing pad may, however, be used for polishing other substrates, such as metal, ceramic, glass, wafers, or hard disks. In polishing applications that use a liquid medium to carry and disperse abrasive particles between the polishing pad and the substrate being polished. Having described preferred embodiments of the invention it will now become apparent to those of ordinary skill in the art that other embodiments incorporating the concepts of the present invention may be used. Accordingly, it is submitted that the invention should not be limited by the described embodiments but rather should only be limited by the spirit and scope of the appended claims.

Claims

1. A polishing pad for polishing a substrate in the presence of a slurry comprising abrasive particles and a dispersive agent, comprising:

   a first layer having a polishing surface and a

backing surface, the first layer formed of a fibrous component in a polymer matrix component, the fibrous component comprising fibers soluble in the slurry sufficiently to provide a void structure in the polishing surface; and

a backing structure comprising an adhesive layer fixed to the backing surface of the first layer.

2. The polishing pad of claim 1, wherein the soluble fibers are soluble in the dispersive agent of the slurry.

3. The polishing pad of claim 1, wherein the slurry is an aqueous slurry and the soluble fibers are soluble in water.

4. The polishing pad of claim 1, wherein the soluble fibers have a diameter selected to allow mobility to particles of the abrasive within the void structure.

5. The polishing pad of claim 1, wherein the soluble fibers have a diameter ranging from 20 to 200 μm.

6. The polishing pad of claim 1 wherein the soluble fibers are made of polyvinyl alcohol, polyacrylic acid, polysaccharides, gums, maleic acid, or derivatives or copolymers of polyvinyl alcohol, polyacrylic acid, polysaccharides, gums, and maleic acid.

7. The polishing pad of claim 1, wherein said fibrous structure is a nonwoven material, a woven material, or a knit material.

8. The polishing pad of claim 1, wherein the fibers are oriented with a plurality of the fibers parallel to the polishing surface.

9. The polishing pad of claim 1, wherein the fibers are oriented with a plurality of the fibers orthogonal to the polishing surface.

10. The polishing pad of claim 1 wherein the soluble fibers are cut fibers.

11. The polishing pad of claim 1, wherein the soluble fibers are continuous fibers.

12. The polishing pad of claim 1, wherein the soluble fibers dissolve at a rate greater than a rate of wearing down of the matrix component.

13. The polishing pad of claim 1, wherein the polymeric matrix component is made of a polymer having sufficient rigidity to support the fibrous component.

14. The polishing pad of claim 1 wherein the polymeric matrix component is made of a polyurethane, a polyacrylate, a polystyrene, a polyimide, a polyamide, a polycarbonate, or an epoxy.

15. The polishing pad of claim 1, wherein the first layer has a ratio of fibrous component to matrix component of 10%/90% to 90%/10% by volume.

16. The polishing pad of claim 1, wherein the first layer has a thickness ranging from 0.005 inch to 0.150 inch.

17. The polishing pad of claim 1, wherein the first layer further includes a surfactant or removal additive.

18. The polishing pad of claim 17, wherein the additive is incorporated within the fibers of the fibrous component or topographically coated onto the fibers of the fibrous component.

19. The polishing pad of claim 1, wherein the fibrous component further includes fibers insoluble in the slurry.

20. The polishing pad of claim 19, wherein the insoluble fibers comprise up to 90% by mass of the fibrous component.

21. The polishing pad of claim 1, wherein the backing structure further comprises two layers of adhesive with a compressible structural layer therebetween.

22. A process of polishing a substrate using the polishing pad of claim 1, comprising:

providing a substrate to be polished; and

polishing the substrate with the polishing pad of claim 1.

23. The process of claim 22, wherein the substrate comprises a semiconductor wafer.

24. The process of claim 22, wherein the substrate comprises metal, ceramic, glass, or a hard disk.

25. A polishing pad for polishing a substrate in the presence of a slurry comprising abrasive particles and a dispersive agent, comprising:

a first layer having a polishing surface and a backing surface, the first layer formed of a soluble component in a polymer matrix component, the soluble component comprising a material soluble in the slurry sufficiently to form a void structure in the polishing surface, the soluble component providing a solid structure in the interior of the first layer; and

a backing structure comprising an adhesive layer fixed to the backing surface of the first

layer.

26. The polishing pad of claim 25, wherein the soluble component comprises a fibrous material.

27. The polishing pad of claim 25, wherein the soluble component comprises a powder material.

28. The polishing pad of claim 25, wherein the slurry is an aqueous slurry and the soluble component is soluble in water.

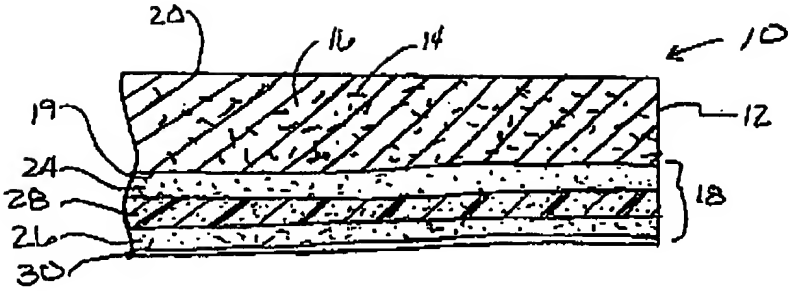

FIG. 1

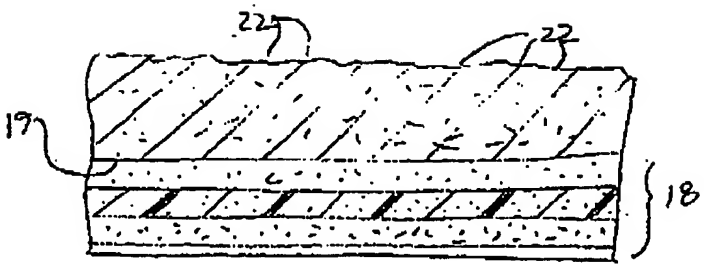

FIG. 3

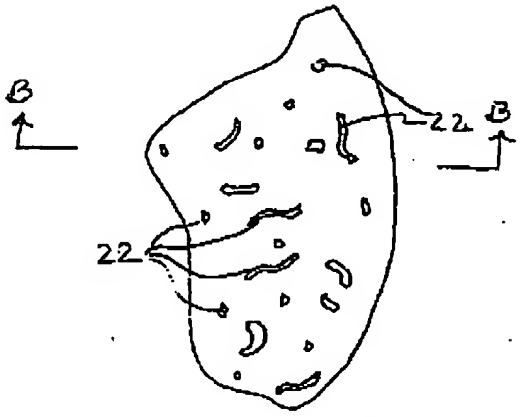

FIG. 2

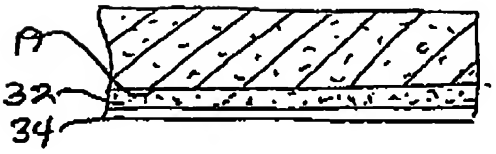

FIG. 4

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 046 466 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
08.10.2003 Bulletin 2003/41

(43) Date of publication A2:
25.10.2000 Bulletin 2000/43

(21) Application number: 00850065.4

(22) Date of filing: 12.04.2000

(51) Int Cl.7: B24D 13/12, B24D 13/14, B24B 37/04 // H01L21/306

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 13.04.1999 US 129048 P
10.04.2000 US 545982

(71) Applicant: Freudenberg Nonwovens Limited Partnership
Durham, NC 27704 (US)

(72) Inventors:
- Hsu, Oscar K.
Chelmsford, Massachusetts 01824 (US)
- Vangsness, Jean K.
Stow, Massachusetts 01775 (US)
- Billings, Scott C.
Kingston, New Hampshire 03848 (US)
- Gilbride, David S.
Lowell, Massachusetts 01852 (US)

(74) Representative: Wiklund, Ingrid Helena
AWAPATENT AB,
Box 5117
200 71 Malmö (SE)

(54) Polishing pads useful in chemical mechanical polishing of substrates in the presence of a slurry containing abrasive particles

(57) A polishing pad (10) for polishing semiconductors and other planar substrates in the presence of a slurry comprising abrasive particles and a dispersive agent is disclosed. The polishing pad (10) includes a soluble component (14), preferably fibrous, within a polymer matrix component (16). The fibrous component (14) includes fibers soluble in the slurry sufficiently to provide a void structure in the polishing surface (20) of the pad (10). The void structure enhances the polishing rate and uniformity by increasing the mobility of the abrasive particles while reducing scratching of the polished surface. Additives that further enhance polishing and/or assist in the removal of residues generated during polishing, such as surfactants and removers, are optionally incorporated in the fibrous substance or topographically coated on the fibrous substance.

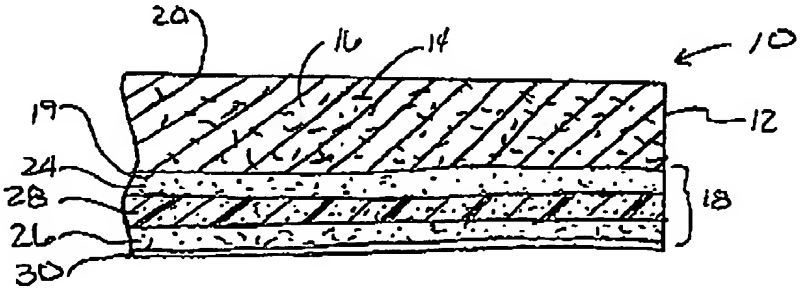

FIG. 1

EP 1 046 466 A3

Printed by Jouve, 75001 PARIS (FR)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 85 0065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	JP 02 088165 A (SPEEDFAM CO LTD) 28 March 1990 (1990-03-28) * abstract; figures 1-4,8-10 *	1-14, 25-28	B24D13/12 B24D13/14 B24B37/04 //H01L21/306
A	EP 0 239 040 A (RODEL INC) 30 September 1987 (1987-09-30) * column 3, line 36 - column 11, line 27; figures 1-4 *	1-14, 25-28	
A	US 5 310 455 A (PASCH NICHOLAS F ET AL) 10 May 1994 (1994-05-10) * column 7, line 25 - column 10, line 60; figures 5-7 *	21	
A	WO 94 04599 A (RODEL INC) 3 March 1994 (1994-03-03)		
A	JP 10 199839 A (MOTOROLA INC) 31 July 1998 (1998-07-31)		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B24D
B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	14 August 2003	Koller, S

CATEGORY OF CITED DOCUMENTS
X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 85 0065

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-08-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 02088165 A	28-03-1990	JP 2668016 B2	27-10-1997
EP 0239040 A	30-09-1987	US 4927432 A	22-05-1990
		CN 87102270 A ,B	06-01-1988
		DE 3777215 D1	16-04-1992
		EP 0239040 A1	30-09-1987
		JP 2559730 B2	04-12-1996
		JP 62297061 A	24-12-1987
		JP 2740143 B2	15-04-1998
		JP 8187655 A	23-07-1996
		KR 9008335 B1	15-11-1990
US 5310455 A	10-05-1994	JP 6077189 A	18-03-1994
		US 5516400 A	14-05-1996
		US 5624304 A	29-04-1997
WO 9404599 A	03-03-1994	AU 4798493 A	15-03-1994
		CN 1082567 A ,B	23-02-1994
		DE 69319435 D1	06-08-1998
		DE 69319435 T2	25-02-1999
		DE 69332490 D1	19-12-2002
		EP 0656031 A1	07-06-1995
		EP 0829328 A2	18-03-1998
		JP 3013105 B2	28-02-2000
		JP 8500622 T	23-01-1996
		KR 191227 B1	15-06-1999
		SG 43335 A1	17-10-1997
		WO 9404599 A1	03-03-1994
		US 6069080 A	30-05-2000
		US 5578362 A	26-11-1996
		US 2003068968 A1	10-04-2003
		US 6439989 B1	27-08-2002
		US 6337281 B1	08-01-2002
		US 5980164 A	04-05-1999
JP 10199839 A	31-07-1998	US 5916011 A	29-06-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82